Increasing the use of DG in the Semiconductor industry

Distributed Power and Industrial DG
Program Review/Peer Review
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- **Technical Project Manager,**
  Tom Rizy, ORNL

- **Project Manager,**
  Barry Cummings, SRP

*Strategic Plan for Distributed Energy Resources **

"Document and widely disseminate the findings of the energy, economic, and environmental benefits of the expanded use of distributed energy resources"

[of combined DER benefits to large energy users, energy suppliers and energy delivery systems]

*Office of Energy Efficiency and Renewable Energy DOE, September 2000

Comprehensive National Energy Strategy(CNES)

- Improve efficiency of energy system
- Ensure against energy disruptions
- Promote energy production and use respecting health & environmental values
- Expand future energy choices

Project status related to CNES goals

- Opportunities limited to new FABs.
- Public Process Manageable.
- Unlikely a ‘major source’ issue
- Inspections and existing review processes will be challenge.
- Requires grid connected DER

Increasing DER Opportunities

- Combining supplier & semiconductor FAB plant benefits
- Technical and economic changes in the next 5 to 10 years

Objectives

- A management decision guideline
- Research tool for site-specific, feasibility studies
- Identified technical and economic improvements needed

SCOPE & LIMITATIONS

- Ownership of DER not in scope
- Contractual and rate issues not in scope:

"Social Economics of Alternatives"

Or

"Is there enough $'s on the table to bother negotiating?"

Semiconductor wafer fabrication characteristics

- Energy-intensive process
- Requires stable electrical power
- Large production losses from poor power quality
- Large production losses from power outages

KEY FAB OWNER NEEDS

- No additional fuel/energy price risk
- Internal rate of return>18%
- Allow 100% factory function with any/all of the DG system shut down
- Installation not impact factory start-up schedule
- Factory reliability improved

DER Supplier’s needs

- Economical compared to other generation alternatives
- DER grid and ‘islanded’ dispatchable by utility
- Does not require 'Major Source' air quality permit
- Highly reliable, i.e. > 98%

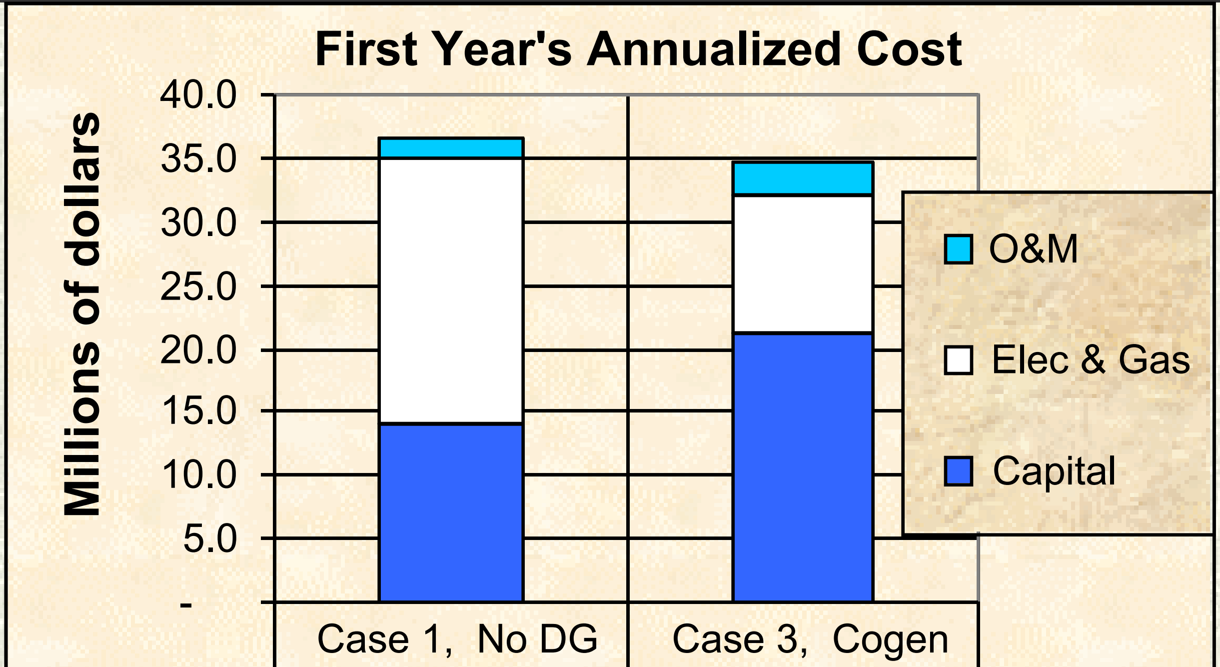
Initial forecasts thru 2010

- Combustion turbines most likely DER for next 5-10 years.
- Fuel cells may become competitive.
- # DER "Retrofits" at existing FABS will be Insignificant. [economics, space, operation, external constraints]

Two alternatives: <u>One</u> GE LM 6000 or <u>Two</u> GE LM 2500

	CASE							
	2A	2B	3A	3B	4A	4B	5A	5B
1-GE LM 6000	X	X	X	X				
2-GE LM 2500					X	X	X	X
Cogeneration	X	X	X	X	X	X	X	X
<u>*Combined Cycle*</u>	X	X			X	X		
<u>*Simple Cycle*</u>			X	X			X	X
Steam Turbine Chillers	X		X		X		X	
Absorption Chillers		X		X		X		X

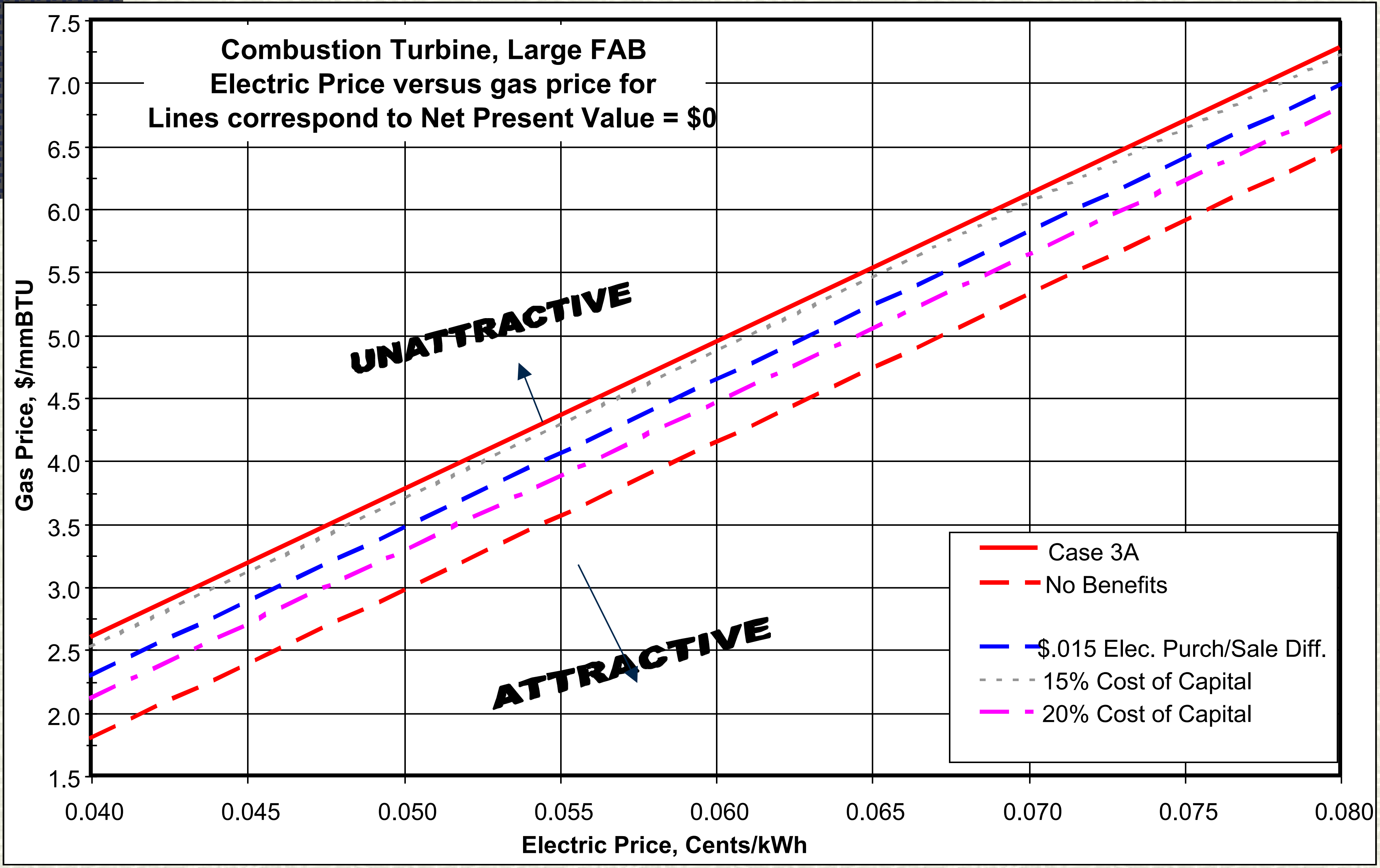
Combustion Turbine DER Annualized Cost*



	Case 1, No DG	Case 3, Cogen
O&M	1.6	2.6
Elec & Gas	21.1	10.8
Capital	13.9	21.2

- Case 3A – Cogeneration, 45 MW combustion turbine,140,000 sq ft clean Room

Key Variables Sensitivity – Combustion Turbine



- Case 3A – Cogeneration, simple cycle 45 MW combustion turbine at 140,000 sq ft

Combustion Turbine DER, ancillary benefits

OPERATIONS

- Product losses from voltage sags > $1.5M/yr
- Delivery system losses reduced >$400,000/yr

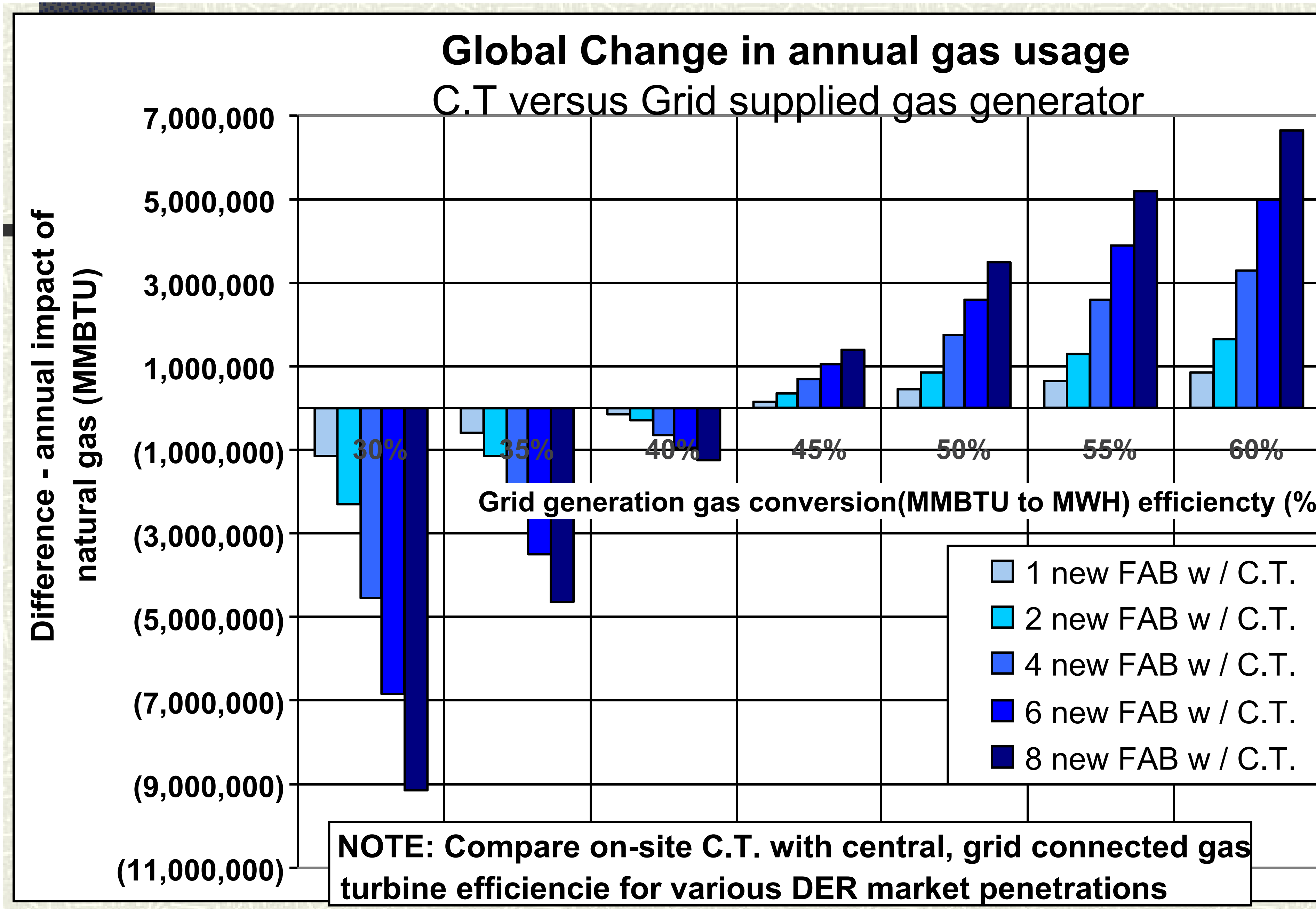
CAPITAL

- $2M for one less redundant transmission line
- $4M Reduced Diesel back-up generation

Combustion Turbine, DER Site (Case 3) Air Emissions

- NO_x - 20 tons per year
- CO - 23 tons per year
- SO_x - 12 tons per year
- Particulate matter* - 45 tons per year
- Volatile organic compounds - 4 tons per year

NOTE: Cogen Simple Cycle Combustion Turbine DER


Global Change in annual gas usage
C.T versus Grid supplied gas generator
7,000,000
5,000,000
3,000,000
1,000,000
(1,000,000)
(3,000,000)
(5,000,000)
(7,000,000)
(9,000,000)
(11,000,000)
Difference - annual impact of natural gas (MMBTU)
30%
35%
40%
45%
50%
55%
60%
Grid generation gas conversion(MMBTU to MWH) efficiencty (%)
1 new FAB w / C.T.
2 new FAB w / C.T.
4 new FAB w / C.T.
6 new FAB w / C.T.
8 new FAB w / C.T.
NOTE: Compare on-site C.T. with central, grid connected gas turbine efficiencie for various DER market penetrations